Introduction to Energy Division Probablistic reliability modeling project

Use of SERVM to model the energy system and produce analysis for qualifying capacity of intermittent resources

RA Workshop | October 15, 2013 | Donald Brooks

California Public Utilities Commission

Agenda

- Scope and Proposed Schedule
- Probabilistic Modeling/SERVM Introduction
- Current Status of Modeling Efforts
- Data Inputs for Model
- Next Steps

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Scoping Memo from August 2nd in R.11-10-023 included (among other topics) two major projects for this track

Flexible capacity requirements for use limited resources	Effective Load Carrying Capacity (ELCC) for wind/solar generators
• Resources can be use limited for a variety of reasons – e.g. energy limits, start limits, fuel limits like wind and sun • Use limits impact ability to economically alleviate reliability problems uniquely, depending on type and level of limit	• How much reliability does a group of generators or an individual generator provide relative to a "perfect" generator? • Ratio of MWs producing same reliability affect

Are these topics related? Yes they are. We can answer both these questions with same model.

Link to Scoping Memo here: http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M075/K391/75391604.PDF

Energy Division plan – conduct probablistic reliability model

Where we are so far

- Energy Division has procured SERVM from Astrape, installed software, and are creating base case to model
- 4 year license for SERVM
- Several staff at CPUC and CEC were trained in November and again this month
- Energy Division will conduct probablistic reliability modeling

Project objectives

- Create probablistic model that studies reliability conditions of the current system and various future scenarios
- Determine ability of resources (generators, DSM, storage) to meet that reliability risk
- Starting with wind and solar generators – pursuant to SB 1x2 – required by statute and is fairly straightforward
- Can apply model to many other purposes – new RA obligations, QC for thermal generators, flexibility analysis.
- Staged approach – ELCC for use limited resources first

*** - SERVM (Strategic Energy Risk Valuation Model)**

Proposed timeline for study process and stakeholder review

- Scoping memo lays out a rough timeline –
  - Issuance of proposal on QC for storage and wholesale DR – September 10th (actually released week after)
  - **Workshop in October (today) – followed by informal comments**
  - **Workshop in November to review modeling assumptions**
  - December issuance of Energy Division proposal on ELCC for wind and solar generators
  - **Two workshops in January – followed by formal comments/replies**
  - Possible reissuance of revised study results
  - **Workshop in March to discuss study results**
  - Development of record and inclusion of study methods and draft ELCC results in proposed decision in May 2014

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Probablistic versus deterministic

Deterministic analysis

- Input one value for each input
- Result of study is one value – generally most impactful or extreme case
- Can model exact scenario – specify each and every variable
- Find most extreme/most impactful result
- Example – CAISO annual Local Capacity study, Transmission Planning study

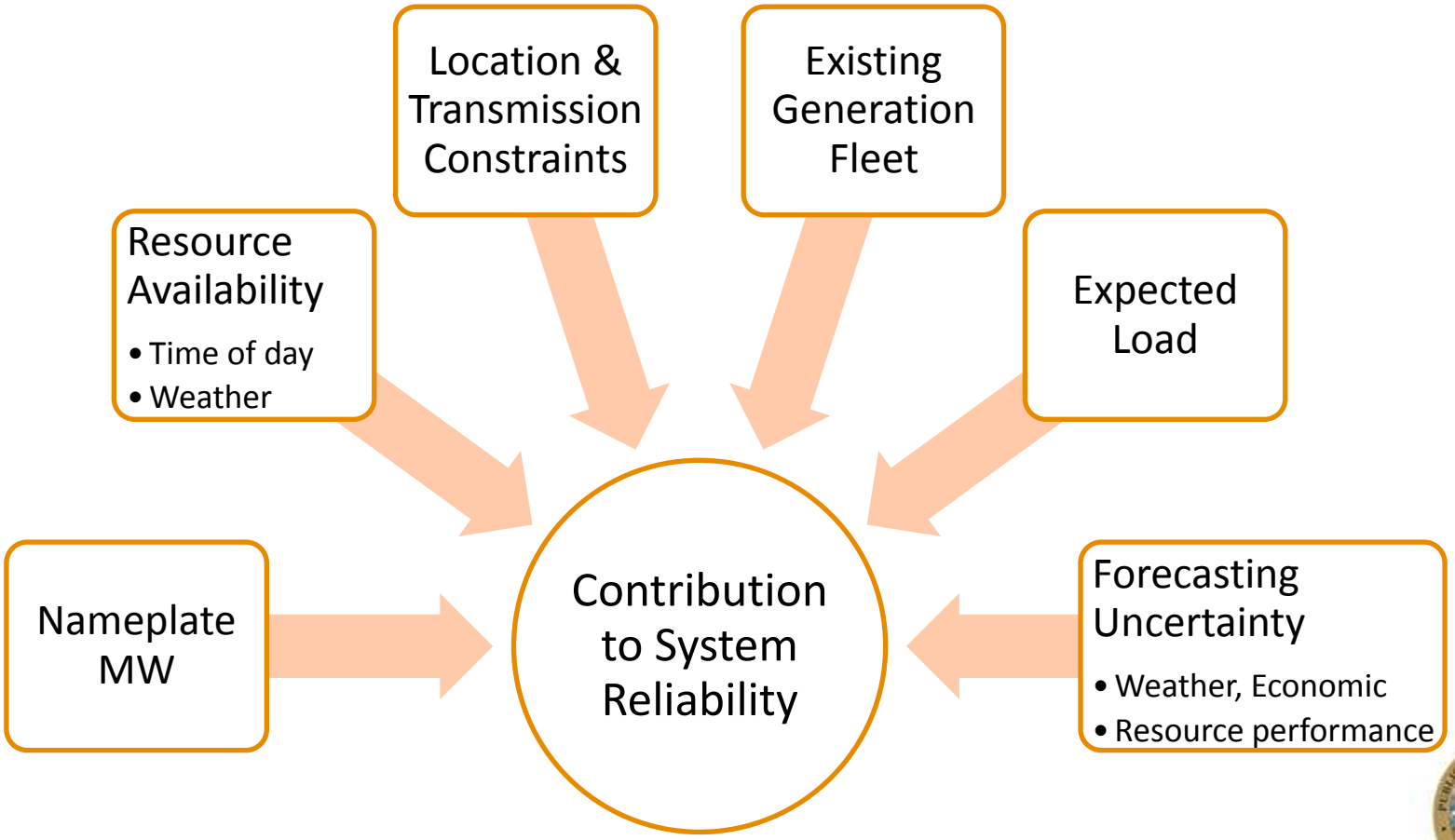
Probablistic analysis

- Input range of values, or one value with uncertainty bars
- Result is expected range over range of inputs
- Model variability around values – impact of variation/uncertainty in analysis
- Find most likely range of results
- Example – Annual installed capacity benefit margin study in NYISO

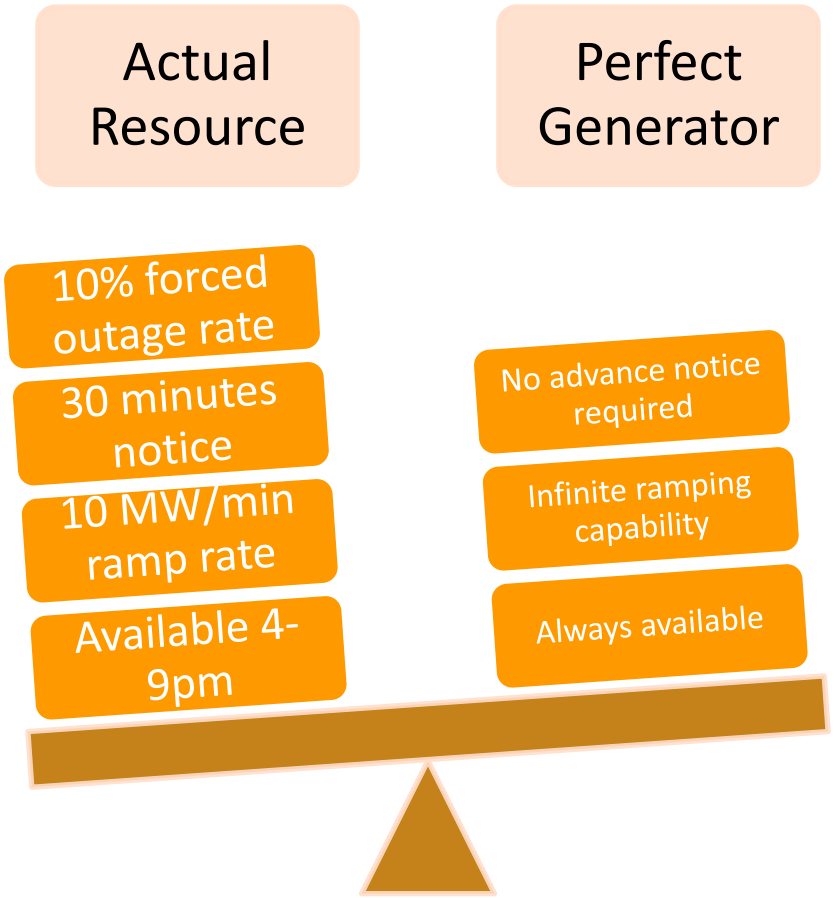
Common variables in probablistic analysis

Common deterministic (unvarying) variables	Common stochastic (drawn from pool of values) variables
1. Size/operating characteristics of conventional generators, planned outage schedules	1. Forced outage rates/in service status of generators on hourly basis
2. Peak and energy demand totals for each month/year	2. Distribution of load shapes, weather
3. Must take non-dispatchable generation – run of river hydro	3. Intermittent non-dispatchable generation profiles – wind or solar facilities
4. Transmission ratings, MW capacity	4. Transmission outage rates

Probabilistic modeling enables an analysis of the interactions between electric use and electric generation



A resource's usefulness relative to a perfect generator is its ELCC or ERC



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Status of modeling effort

- Intent to benchmark and match existing modeling effort when possible – divide CA into same regions as CAISO analysis and use several sets of CAISO inputs, try to study same future year as CAISO to benchmark
- Staff has been trained in the model, staff is splitting up tasks and completing data gathering
- Staff intends to conduct modeling within 2-3 weeks after final case base is compiled
- Staff intends to hold further workshops later in November to go over more detailed modeling assumptions

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Broad outline of model

- Staff is using SERVM model to perform standard LOLE and EUE analysis; staff is also developing data for flexibility analysis
- Staff is modeling WECC – 8 regions in CA and another 10 regions external to CA (Mexico, Canada, Montana, etc.) all individually with same granularity of individual loads and individual units
- Initially staff is creating a base case to model 2015 year with 33 load shapes per region and over 1500 individual or aggregated generating units, but also developing sensitivities and base cases for at least 2-3 future years

Data inputs and their proposed source

Data input	Proposed source
1. Name/MW size/Operating characteristics (ramp rate, heat rate) for conventional generators	1. CAISO NQC/MasterFile info for in CAISO gen, PLEXOS 2020 data for non-CAISO gen
2. Load shapes for California (CA) areas	2. Used neural net modeling to create weather-load predictor relationship then use weather data to create 33 weather variations of load for each region
3. Load shapes/wind-solar shapes for external to CA regions	3. WECC path ratings and PLEXOS 2020 data set
4. Transfer between areas internal to CA and external to CA	

Data inputs and their proposed source – cont'd

Data input	Proposed source
1. Wind/solar profiles – in CAISO	1. CAISO settlement data for wind and solar facilities normalized to MW in service at the time
2. Outage information for generators – all regions	2. GADS event data used to create outage statistics for individual generator (EFOR, mean time to repair, mean time to fail)
3. Load forecast error – short term and long term	3. CEC for long term error, CAISO actual forecast error from historical MRTU for short term (1 day, 1 hour) error
4. Wind and solar forecast uncertainty	4. To be determined

Data inputs and their proposed source – cont'd

Data input	Proposed source
1. Gas and other fuel prices	1. CEC staff – IEPR forecasting
2. Fuel handling and start up costs	2. PLEXOS data and CAISO masterfile for start up times and costs, PPAs for fuel handling when info is known, data request to utilities. This is work in progress
3. Future buildouts of renewable or conventional facilities	3. Data request to utilities or PLEXOS 2020 data

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Next Steps

Data basing and modeling

1. Continue development of base case – clean and format data
2. Assemble modeling scenarios
3. Complete modeling runs and create output reports

Process and stakeholders

1. Hold further workshop to go over modeling inputs in November
2. Complete draft modeling and document results – issue report in December
3. Stakeholder comments filed in January
4. Two workshops covering modeling results in March

Thank you!

For Additional Information:

www.cpuc.ca.gov